moteness, has been little explored geologically; the present paper contains in part data obtained by the author during five months in 1895. The formations represented are divided into sedimentary and igneous, the former of which includes two distinct classes: (1) a metamorphic series, ranging in age from Cambrian through the Triassic, and (2) the unaltered Tertiary and Quaternary beds. The igneous rocks are granitic and volcanic; the former occur frequently as intrusions in the metamorphic series, and the latter consist of tuffs, liparites, andesites and basalts.

The Association of the Gasteropod Genus Cyclora with Phosphate of Lime Deposits: By A. M. MILLER. Several specimens of phosphate rock examined showed numerous shells of *Cyclora*. The analysis of the rocks as a whole gave varying percentages of P_2O_5 and $Ca_3(PO_4)_2$, while analyses of the *Cyclora* casts showed them to contain a much larger amount of these compounds. In one case 89 per cent. of the material of the casts was found to consist of these compounds.

The Buchanan Gravels: An Interglacial Deposit in Buchanan County, Iowa: By SAMUEL CALVIN. These gravels in their typical exposures form beds ten to fifteen feet in thickness, lying above the Kansan drift and below the Iowan. The contrast between the hard undecayed boulders of the Iowan drift and the decayed boulders of the Buchanan gravels and Kansan drift is striking. These gravels are made up of materials derived from the older drift and were probably laid down in water immediately behind the retreating edge of the Kansan.

Lacroix' Axial Goniometer: By N. H. WINCHELL. This paper describes and figures a comparatively simple apparatus for easily measuring the optical angle of a mineral; it can be adjusted to any microscope, being inserted in the top of the body tube, and gives the optical angle measured in air.

Phenomena of Falling Meteorites: By O. C. FARRINGTON. The author discusses the explosions of meteorites and the sounds which accompany the fall of these bodies. Evidence is given which shows that meteorites sometimes do explode, producing marked detonations.

Philadelphia Meeting of the Geological Society of America: By WARREN UPHAM. An account of this meeting is given, together with abstracts of all the papers presented and also abstracts of the discussions following the papers.

Under 'Editorial Comment' notice is made of Prof. James Hall's gold medals, of the Transvaal gold region, and of the geological map of Europe prepared by the International Congress of Geologists. Under 'Personal and Scientific News' abstracts are given of geological papers presented at recent meetings of various scientific societies.

SOCIETIES AND ACADEMIES.

THE SCIENTIFIC ASSOCIATION OF THE JOHNS HOPKINS UNIVERSITY, DECEMBER 19.

ONE hundred and twenty-third regular meeting, December 19, 1895. President Remsen in the chair.

The following papers were presented and read:

1. *Theories of Color Sensation and of the Perception of Sound:* By W. J. MATHER.

Mr. Mather gave a brief review of the older theories of color perception, followed by a careful discussion of the present state of our knowledge of this suject. He dwelt especially upon the theories of Mrs. Franklin.

2. *Recent Work on Impregnation in Flowering Plants:* By J. E. HUMPHREY.

Mr. Humphrey showed that until about four years ago impregnation in flowering plants was known to take place only by the growth of the pollen tube across the cavity of the ovary and through the micropyle left by the coats of the ovule. In 1891 Treub described impregnation in Casuarina, the Australian iron-wood, by the downward growth of the pollen-tube through the tissue of the ovary to the chalaza, or stalk of the ovule, and its upward growth through the body of the ovule to the egg-cell. In 1894 Miss Benson found the same thing to occur in several English catkin-bearing plants, the hornbeam, the alder, the hazel, etc.

Nawaschin has just published the results of his studies of the white birch, which agrees closely with the alder. In attempting to ex-

plain chalazal impregnation, he points out that the entire course of the pollen-tube of the Gymnosperms is through tissue. He thinks that in the primitive Angiosperms, the descendants of the Gymnosperms, the tube has not yet acquired the ability to grow across open spaces, and therefore takes the indirect route which enables it to make its whole course through tissue. He also announces that the elm constitutes an intermediate form between those with chalazal and those with the micropylar impregnation.

Much work on this line is yet to be done, which may throw light on relationships among flowering plants.

On motion the meeting adjourned.

JANUARY 23.

ONE hundred and twenty-fourth regular meeting, January 23, 1896. President Remsen in the chair.

The following papers were presented and read:

1. *The Temperature of the Earth's Interior:* By G. K. GILBERT.

The speaker first pointed out the difficulty attending any investigation of the earth's interior, and stated that in the present condition of physical science all estimates of interior temperature are necessarily founded on questionable postulates. He then gave the results of a series of computations of the average temperature, each starting with a group of postulates.

2. *The Effect of Pressure on the Wave-Lengths of Lines in the Arc-Spectra of Certain Elements:* By J. F. MOHLER.

Mr. Mohler first pointed out that these wave-lengths had been considered as constants, and that it had even been proposed to use them as fundamental standards of length. This was followed by a detailed account of a series of experiments carried on in the Physical Laboratory of the Johns Hopkins University, which clearly establish the fact that these wave-lengths vary with the pressure. Pressures as high as twelve atmospheres were used. Diagrams were exhibited showing the results of the investigations.

The following papers of research were then presented and read by title:

1. *On Infinite Products:* By A. S. CHESSIN. (University Circulars: J. H. U.)

2. *Additional Note on Divergent Series:* By A. S. CHESSIN. (Bull. Am. Math. Society.)

On motion the meeting adjourned.

CHAS. LANE POOR, *Secretary.*

BOSTON SOCIETY OF NATURAL HISTORY.

THE Society met January 1st, forty-three persons present.

Prof. W. O. Crosby and Mr. A. W. Grabau showed that the chief deposits of modified drift in and about the Boston Basin could be referred to a connected chain of glacial lakes along the southern and western borders of the basin. These lakes existed between the receding margin of the ice sheet and the watersheds of the streams tributary to Boston Harbor, and, after the manner of lakes of this class, they were, through the continued recession of the ice margin, somewhat migratory in character and subject to great variations in outline, area, and level. During the period of the maximum and most interesting development of these lakes, the general trend of the ice margin was east-west along the southern border of the basin and north and northwest across the western end of the basin from the western end of the Blue Hills to the highland of Weston and Waltham; the ice, in accordance with the well established principles governing the motion of an ice sheet, having lingered on the depressed areas of the Boston Basin and Boston Harbor after it had disappeared from the relatively high land forming the western border of this great trough.

Along the south side of the basin, in Hingham, Weymouth, Braintree, Randolph, and Quincy, was formed Lake Bouvé (named in honor of Mr. T. T. Bouvé, a former President of the Boston Society of Natural History), some twelve miles in length. Its different levels, as determined by successive outlets, first south into North River and later east into Cohasset Harbor, were approximately 140 feet (Liberty Plain), 70 feet (Glad Tidings Plain), and 50 feet (Lower Plain). Other glacial lakes were formed in the upper basins of the Neponset and Charles Rivers. At their highest levels (240 to 300 feet) these were independent and tributary, respectively, to the Taunton and Blackstone Rivers. But at the level of 200 feet they were confluent and had a common outlet into the

valley of Taunton River. Still later an outlet was opened eastward along the south side of the Blue Hills into Lake Bouvé at a height of about 160 feet. The plains formed during this stage of the Charles-Neponset Lake extend eastward across Wellesley and Needham into Newton and West Roxbury, and northward across the broad water-parting (now occupied by Lake Cochituate) between the Charles and Sudbury Rivers, and thence, apparently, down the valley of the Sudbury and Concord Rivers into Billerica.

The western edge of the great angle or lobe of the ice sheet naturally receded eastward more rapidly than the southern edge receded northward, and so it happened that the ice continued to form a solid barrier across Boston Harbor after it had disappeared from all the country between the Blue Hills and Arlington Heights. The drainage of the Neponset and Charles Basins thus eventually became tributary to Lake Bouvé along the north side of the Blue Hills, at the height, first, of Glad Tidings Plain, and, later, of Lower Plain. Plains of these heights have an extensive development in the lower valleys of the Charles and Neponset Rivers, across the site of Boston, and also in the upper valley of the Mystic River, outlining a body of standing water, which it is proposed to call Lake Shawmut, from the Indian name for Boston.

When the front of the ice sheet receded from the high land terminating in Fox Hill, northeast of Billerica Center, the drainage of the Concord, Merrimac, and Shawsheen Valleys probably found an outlet southeastward, along the course of the Boston and Lowell Railroad and the old Middlesex Canal, into the valley of the Mystic, and thence through Lake Shawmut and Lake Bouvé to Cohasset Harbor. In the glacial lake thus conditioned north of the Mystic water-parting were deposited the extensive plains having a normal height of about 100 feet, which stretch across Wilmington, northern Billerica, Tewksbury, and Lowell. It is very probable, also, that later a part of this northern drainage found its way southward through the valleys of the Malden and Saugus Rivers.

SAMUEL HENSHAW,
Secretary.

NEW YORK ACADEMY OF SCIENCES, BIOLOGICAL SECTION. JANUARY 13.

THE papers presented were:

G. S. HUNTINGTON, '*On The Visceral Anatomy of the Edentates.*' The characters of the brain, alimentary, respiratory and genito-urinary tracts were especially considered. The following forms were discussed: *Myrmecophaga jubata, Tamandua bivittata, Arctopithecus didaclylus, Dasypus sexcinctus, Tatusia novemcincta, Manis longicandata.* In the brain characters the following features were considered: the transverse frontal sulcus, the great longitudinal fissure, and the absence of a distinct Sylvian fissure. In the alimentary tract the Sloths are to be sharply separated from the remaining groups, the stomach structure with its pyloric gizzard notably aberrant: the ileo-colic junction is traced throughout the Edentates in a well marked series of transitional forms.

O. S. STRONG, '*On the Use of Formalin in Injecting Media.*' The paper made especial note of the advantages posessed by this preservative in injecting in brain in situ. Formalin (40% formaldelyde) diluted with an equal volume of water is injected into the cephalic vessels until it runs from the cut jugulars. After a few minutes the same quantity is again injected, and once or twice again after an elapse of fifteen to twenty minutes. The brain is then removed and will be found to be completely fixed throughout. The swelling usually noticed in formalin hardened brains does not appear to take place when this method is employed. Besides the many general advantages of fixing brains by injection, formalin has the especial merit of giving them the best consistency for microscopic work, and further, such brains are available subsequently for the Golgi and Weigert methods, as well as possibly for cytological methods. Formalin also has the advantage that it can be used, as above, stronger than is necessary for fixation and thus allowance made for its dilution when permeating the tissue. When only the Golgi method is to be used, an equal volume of a 10% solution of potassium bichromate may be added to the formalin instead of water. Pieces may be subsequently removed, hardened further in formalin-bichromate and impregnated with silver.

Bashford Dean, '*On the Supposed Kinship of the Paleospondylus.*' A favorably preserved specimen of this interesting fossil, received by the writer from Wm. T. Kinnear of Forss, Scotland, appears to warrant the belief that this lamprey-like form was possessed of paired fins, a character decidedly adverse to the now widely accepted view of Marsipobranchian affinities. The structure referred to consists of a series of transversely directed rays, arising from the region of the postoccipital plates of Traquair. From this peculiar character, as well as from many unlamprey-like features of the fossil, it would appear accordingly that the kinship of the Paleospondylus is as yet by no means definitely determined.

C. L. Bristol,
January 13, 1896. *Secretary of Section.*

SECTION OF GEOLOGY AND MINERALOGY.

At the meeting of the section of Geology and Mineralogy of the New York Academy of Sciences held January 20th, Prof. J. J. Stevenson in the chair, the following papers were presented:

The first, by E. O. Hovey, described the new and remarkably fine specimens of rare minerals recently discovered by Mr. Niven in the upper part of New York City. A doubly terminated tourmaline, 9½ inches long by 4½ inch diameter, was shown, and also unusually large samples of xenotime and monazite. The largest xenotime was ⅛ of an inch in diameter, the monazite was about ⅛ of an inch on the long edge. Fuller details regarding the crystallography appear in the Bulletin of the American Museum of Natural History of recent date. The specimens are now in the museum.

The second paper was by J. F. Kemp and T. G. White, and brought out the results of further exploration in the Adirondacks, the Lake Champlain Valley and the Green Mountains as regards the distribution of the trap dikes, well known from that region. One was cited on Mount McIntyre about 4,000 feet above tide, and others from various interior points in the Adirondacks. Microscopic study shows that they are in instances both camptonites and fourchites. This modifies the previous experience of Kemp and Marsters, who had found only diabase dikes in the Archean rocks. A great number of dikes were mentioned from the shores of Willsboro' Bay, on the New York side; one dike of camptonite was described from the granite quarries near Barre, Vt., and one from the Eustis pyrites mine, near Sherbrooke, Que. These outlying dikes materially extend the area in which they had been previously known. Very curious exposures were also described as having been recently uncovered in the Willard's Ledge quarries at Burlington, Vt. The paper concluded with some reflections on the petrology of the dikes. It will appear in full in the Transactions of the Academy.

The paper was followed by one by W. D. Matthew describing the metamorphism of Triassic coals at Egypt, N. C., by the intrusion of diabase dikes. Beginning with samples of coal at a distance of seventy feet from the dike it was shown that there is a progressive loss of volatile hydro-carbons as the igneous rock is approached, and that the bituminous coal passes into anthracite and this into prismatic coke next the dike. Geological sections and tables of analyses were shown. Attention was called to the fact that similar phenomena have been previously described from Virginia, but not from Egypt, N. C. The paper will appear in full in the Transactions of the Academy.

The last paper was by J. J. Stevenson on 'The Cerrillos Coal Fields near Santa Fé, N. M.' Prof. Stevenson brought out, by means of geological sections, that there were four coal seams contained between two laccolites of trachyte which had spread sidewise between the beds for nearly a mile from the parent dike or neck. In the topmost seam next the neck the coal was a graphitic anthracite passing, as the neck was left behind, into true anthracite, which graduated into semi-bituminous, and this into bituminous coking coal. The nearness of the laccolites appeared to exercise but little influence on the seams that were immediately over or under them, but the metamorphic change was due to the dike. The middle seam, which is at a maximum distance from the two laccolites, is bituminous coal throughout, so far as known, but it has not been worked near the dike. The speaker also referred to the change in our former ideas regarding the geology of

the region, in that the intruded rocks have proved to be in two separate laccolites, where they were formerly thought to be in innumerable dikes. The paper was discussed by J. F. Kemp, who referred to the fact that the metamorphic changes were doubtless due to vapors or heated waters set in circulation by the dike; to which the speaker assented. The paper will appear in full in the Transactions.

J. F. KEMP,
Secretary.

MEETING OF THE NEW YORK SECTION OF THE AMERICAN CHEMICAL SOCIETY.

THE regular monthly meeting of the New York Section of the American Chemical Society was held at the College of the City of New York, 23d street and Lexington avenue, on Friday evening, January 10th.

Mr. G. C. Henning, M. E., delegate for the American Society of Mechanical Engineers, reviewed the 'Present Status of Iron and Steel Analysis,' calling attention to the discrepancies in some recent work of different chemists in determining the constituents of the same quality of steel, with special reference to carbon and phosphorus, and to the omission of the direct determination of iron, which he thinks conducive to overlooking such elements as titanium, tungsten and others, which are more often present than the usual iron analysis would indicate, as they are but infrequently determined directly.

He considers that the microscope has opened a field which marks a great advance in methods of determining the condition and quality of iron and steel, and thinks that chemical methods need great improvement to distinguish the conditions in which the carbon exists.

Mr. Rossi in discussing Mr. Henning's paper thought it would be very difficult, if not impossible, to recognize the different combinations of iron and carbon by chemical means, at least in the present state of chemical science, since there is so little outside of physical characteristics to distinguish them. In replying to these remarks, Mr. Henning said that several steel and iron companies in this country have already established very complete micrographic laboratories, where in three hours an accurate determination of the condition of any specimen of the daily output may be secured.

Papers were were read by Mr. G. C. Stone on 'The Probable Formation of Permanganates by Direct Combustion of Manganese' and 'Remarks on the Volhard Method of Determining Manganese;' by Dr. E. R. Squibb, on the 'Manufacture of Acetone and Acetone-Chloroform from Acetic Acid,' in which he reviewed the history of acetone from its first mention to the present date, and by Mr. J. S. Stillwell on Highly Compressed Gases.'

Dr. Squibbs showed that owing to the quotation, in standard works of reference, of erroneous results obtained by earlier experimenters, the progress of the manufacture of acetone had, for many years, been obstructed, and consequently the successful manufacture of chloroform from acetone had been correspondingly delayed.

Mr. Stillwell discussed the causes of explosion of cylinders of compressed gases with especial reference to those explosions which were supposed to result from the chemical combination of the compressed gas (oxygen) with oil or grease used as lubricant, and carried into the cylinders. He maintains that a temperature of 400° F. is required to produce such chemical combination, and that this temperature is never reached under normal working conditions.

DURAND WOODMAN,
Secretary.

GEOLOGIGAL SOCIETY OF WASHINGTON.

AT the 41st meeting of this Society, held in Washington, D. C., January 22d, two communications were presented, one by Mr. Arthur Keith, on the 'Crystalline Groups of the Southern Appalachians,' and the other by Prof. Chas. R. Van Hise, of the University of Wisconsin and the U. S. Geological Survey, on 'Primary and Secondary Structure and the Forces that Produced them.'

Mr. Keith described seven classes of formations, in which no sedimentary origin appeared. These comprised mica, gneiss and schist of three types, granite of five types, diorite of two types, gabbros of two types, peridotite and pyroxenite of five types, basalt and diabase of five types, andesite of two types, quartz porphyry and rhyolite of four types.

These formations occupy long narrow belts, comparable in extent with the sedimentary rocks, and belts of plutonic rocks alternate with volcanic rocks. Attention was called to the prevalence and attitudes of the schistose plane, due to deformation, and to the similar deformation of sediments and crystallines in the same area. The whole series of stratigraphic and structural results in sediments and crystallines was classified as part of the Appalachian system.

Prof. Van Hise discussed the relations of secondary structures to the forces that produced them, and it was concluded that there have been two entirely different structures described under the term 'cleavage.' Following the English geologists, it was held that one of these structures develops normal to the pressure in a deep-seated zone of rock flow, and that this ought properly to be called 'cleavage.' Following Becker it was held that there have often developed two intersecting structures on shearing planes in the zone of fracture. For this structure the term 'fissility' was proposed.

Mr. Becker, in discussing Prof. Van. Hise's paper, expressed himself as certain that true cleavages as well as ruptures are produced at large angles (not necessarily 45°) to the line of force. He regards the existence of such cleavages as well established, both by experiment and by theory. In his opinion, no adequate theoretical or experimental basis exists for asserting that cleavage is normal to force, and field observations on slates leave the exact direction of force to inference.

The communication, which was listened to with much interest, was illustrated by a number of diagrams.

On account of the importance of the subject it was proposed to invite Prof. Van Hise to give the Society a more extended presentation of it at the meeting to be held January 29th.

W. F. Morsell.

INDIANA ACADEMY OF SCIENCE.

The eleventh annual meeting of the Indiana Academy of Science was held at Indianapolis, December 27–28, 1895.

The meeting was quite largely attended and much interest was manifested. More than forty new names were added to our list of members.

The address of the retiring President, Mr. Amos W. Butler, on 'Indiana: A Century of Changes in the Aspects of Nature,' was intensely interesting and very instructive.

The papers were numerous and most of them of importance to the scientific work of the State.

The report of the Biological Survey on Turkey Lake deserves special mention. It indicated a great amount of work and will be productive of much good in creating a deeper interest in such work. Many papers ought to be mentioned, but space will not permit.

The officers for the next year are as follows: President, Stanley Coulter, Purdue University; Vice-President, Thomas C. Gray, Rose Polytechnic; Secretary, John S. Wright, Indianapolis; Assistant Secretary, A. J. Bigney, Mooles Hill College; Treasurer, W. P. Shannon, Greensburg.

The Spring meeting will probably be held in connection with the Ohio Academy, near the State line.

A. J. Bigney,
Assistant Secretary.

NEW BOOKS.

Anleitung zur Mikrochemischen Analyse. H. Behrens. Hamburg & Leipzig, Leopold Voss. 1896. Pp. xiii+108. M. 5.

Handbook to the British Mammalia. R. Lydekker. London, W. H. Allen & Co. Limited. 1895. Pp. xiii+339.

The Elements of Physics, Vol. I., Mechanics and Heat. Edward L. Nichols and William S. Franklin. New York and London, Macmillan & Co. 1896. Pp. xi+228. $50.

The Story of the Solar System. G. F. Chambers. New York, D. Appleton & Co. 1896. Pp. 181. 40 cents.

Life, Letters and Works of Louis Agassiz. Jules Marcou. New York and London. 1896. Vol. I., pp. ix + 303; Vol. II., pp. x + 318. $4.00.

Old Faiths and New Facts. William W. Kensley. New York, D. Appleton & Co. 1896. Pp. 345. $1.50.

Studies of Childhood. James Sully. New York, D. Appleton & Co. 1896. Pp. viii + 527. $2.50.